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Our Case No. 9281-4198
Client Reference No. S US00144

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Yuji Yanagisawa

Serial No. To be Assigned

Filing Date: Herewith

For Battery with Protection Circuit for Preventing Malfunction

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to examination of the above-identified application, please amend the application as follows:

In the Specification

Please rewrite the paragraph beginning on page 1, line 23 and ending on page 2 line 7 follows:

(Amended) The protection switch 25 comprises a charging shutdown switch 25a that shuts down charging to the batteries 21a and 21b and a discharging shutdown switch 25b that shuts down discharging from the battery to the load, and these switches are configured in the form of FETs. The source of the charging shutdown switch 25a is connected to the negative electrode 21f of the battery 21b and the drain of the charging shutdown switch 25a is connected to the source of the discharging shutdown switch 25b, and the drain of the discharging shutdown switch 25b is connected to the - terminal 23.

Please rewrite the paragraph beginning on page 4, line 23 and ending on page 5, line 3 as follows:

(Amended) An insulating member 32 consisting of a vinyl film is disposed so as to cover the substrate 30 partially including the detection integrated circuit 31 and the protection switch integrated circuit 32. However, the - terminal 23 is not covered with the insulating member 32. A shield member 33 consisting of a copper foil is provided on the insulating member 32, and the shield member 33 is connected to the - terminal 23 with solder 34.

Please rewrite the paragraph on page 5, lines 4-21 as follows:

(Amended) Because, in the abovementioned conventional battery with a protection circuit, the shield member 33 is grounded at one soldered point, the protection switch 25 and detection circuit 26 of the protection circuit 24 disposed at the point far from the solder 34 are not shielded sufficiently. As the result, an external radio wave passes through the shield member 33 and is superimposed on a current that flows through the protection circuit 24 due to electromagnetic induction, and the protection circuit 24 can malfunction. When the protection circuit 24 malfunctions, the protection switch 25 is turned off even when overcharge, over-discharge, or overcurrent does not occur, and supply of power source voltage to the load can be shut down. Particularly the battery is used for a radio system that usually has an antenna near the battery with a protection circuit, which is exposed to a strong radio wave, and the low shield effect of the shield member 33 can cause malfunction of the radio system easily.

Please rewrite the paragraph beginning on page 7, line 14 and ending on page 8, line 1 as follows:

(Amended) FIG. 1 is a circuit diagram showing a battery with a protection circuit, and the battery comprises a power source 1 having batteries 1a and 1b connected in series, a protection circuit 4, and a + terminal 2 and a - terminal 3 connected to both ends of the power source 1 respectively. A load not shown in the drawing is connected between the + terminal 2 and the - terminal 3, and is ground at the portion that is connected to the - terminal 3. The protection circuit 4 has a protection switch 5 interpolated between the power source 1 and the load and a detection circuit 6 detects abnormalities of the batteries 1a and 1b and to turns off the protection switch 5.

Please rewrite the paragraph on page 8, lines 2-12 as follows:

(Amended) The protection switch 5 comprises a charging shutdown switch 5a that is served to shuts down charging to the battery, and a discharging shutdown switch 5b that shuts down discharging from the battery to the load, and both switches are configured in the form of FETs. The source of the charging shutdown switch 5a is connected to the negative electrode 1f of the battery 1b, the drain of the charging shutdown switch 5a is connected to the source of the discharging shutdown switch 5b, and the drain of the discharging shutdown switch 5b is connected to the - terminal 3.

Please rewrite the paragraph beginning on page 8, line 13 and ending on page 9, line 2 as follows:

(Amended) The detection circuit 6 is provided with a positive electrode terminal 6a connected to the positive electrode (the positive electrode 1c of the battery 1a) of the power source, a middle point terminal 6b connected to the negative electrode 1d of the battery 1a and the positive electrode 1e of the battery 1b, a negative electrode terminal 6c connected to the negative electrode (the negative electrode 1f of the battery 1b) of the power source 1, a delay terminal 6d connected to the detection delay capacitor 7a, a voltage detection terminal 6e connected to the positive electrode (the positive electrode 1c of the battery 1a) of the power source through a resistor 8a, an overcurrent detection terminal 6f connected to the - terminal 3 through a resistor 8b, a control terminal 6g connected to the gate of the protection switch 5a, and a control terminal 6h connected to the gate of the protection switch 5b.

Please rewrite the paragraph on page 9, lines 3-7 as follows:

(Amended) The protection switch 5 and the detection circuit 6 are covered with the insulating member 12 and shield member 13 as described hereinafter, and the negative electrode 1d of the battery 1a and the shield member 13 form a capacitor 7b together. Capacitor 7b is effectively connected between the ground and the negative electrode 1d of the battery 1a (or positive electrode 1e of battery 1a).

Please rewrite the paragraph on page 9, lines 12-19 as follows:

(Amended) When the battery becomes overcharged, the voltage difference between the voltage detection terminal 6e and the negative terminal 6c attains to a

value equal to or higher than a predetermined value and the detection circuit 6 detects overcharging of the batteries 1a and 1b resultantly, and the control terminal 6g outputs a high level and the charging shutdown switch 5a of the protection switch 5 is turned off.

Please rewrite the paragraph on page 9, lines 20-27 as follows:

(Amended) On the other hand, when the battery becomes over-discharged, the voltage difference between the voltage detection terminal 6e and the negative electrode terminal 6c drops to a value equal to or lower than another predetermined value and the detection circuit 6 detects over-discharge, and the control terminal 6g outputs a high level and the discharging shutdown switch 5b of the protection switch 5 is turned off.

Please rewrite the paragraph on page 10, lines 1-10 as follows:

(Amended) Furthermore, when an overcurrent flows through the batteries 1a and 1b, a current that flows through the protection switch 5 increases to result in a large voltage drop between both ends of the protection switch 5, the voltage difference between the overcurrent detection terminal 6f and the negative terminal 6c becomes large, the detection circuit 6 detects the overcurrent, the control terminal 6g or 6h outputs a high level, and the charging shutdown switch 5a or the discharging shutdown switch 5b of the protection switch 5 is turned off.

Please rewrite the paragraph beginning on page 10, line 11 and ending on page 11, line 16 as follows:

(Amended) FIG. 2 is a perspective view showing the configuration of the battery with the protection circuit. The batteries 1a and 1b are rectangular and placed one on the other. The right side face not shown in the drawing of the lower side battery 1b serves as the positive electrode 1e and other five faces serve as the negative electrode 1f. The battery 1a is disposed on the battery 1b with interposition of the insulating film 9a, and the left side face serves as the positive electrode 1c and other five faces serve as the negative electrode 1d. The negative electrode 1d of the battery 1a is connected to the positive electrode 1e of the battery 1b with the metal foil 11c, and the batteries 1a and 1b are connected in series. A substrate 10 on which the protection circuit 4 is mounted is provided partially on the upper surface of the battery 1a. The detection circuit 6 having an integrated circuit structure and the

protection switch 5 having an integrated circuit structure are disposed on the substrate 10. Furthermore, the positive electrode 1c of the battery 1a is connected to a wiring pattern (not shown) on the substrate 10 through the metal foil 11a, the negative electrode 1f of the battery 1b is connected to a wiring pattern on the substrate through the metal foil 11b, and the negative electrode 1d of the battery 1a and the positive electrode 1e of the battery 1b are connected to a wiring pattern on the substrate 10a through the metal foil 11c. Furthermore, the + terminal 2 consisting of a metal foil and the - terminal 3 consisting of a metal foil are connected to the substrate 10, and the + terminal 2 and the - terminal 3 are disposed on the side surfaces of the batteries 1a and 1b with interposition of the insulating film 9b.

Please rewrite the paragraph beginning on page 11, line 17 and ending on page 12, line 7 as follows:

(Amended) The insulating member 12 consisting of a vinyl film is disposed on the upper surface of the substrate 10 so as to cover the upper surface of the battery 1a partially, to cover the side surface of the battery 1a partially, and to cover the detection circuit 6 and the protection switch 5. The insulating member 12 does not cover the top side of the - terminal 3. The shield member 13 consisting of a copper foil is disposed on the insulating member 12 and the - terminal 3 so as to partially cover the - terminal 3, and the shield member 13 is connected in series to the - terminal 3 with solder 14. Because the upper surface and the side surface of the battery 1a serve as the negative electrode 1d of the battery 1a, the negative electrode 1d of the battery 1a, the insulating member 12, and the shield member 13 form the capacitor 7b. As the result, the shield member 13 is connected to the negative electrode 1d of the battery 1a in a high frequency fashion.

In the Claims

Please rewrite Claim 1 as follows:

1. (Amended) A power source comprising:

at least one battery;

a protection circuit including a protection switch disposed between a load having one end that is grounded and the battery and a detection circuit that detects one of overcharging and over-discharging of the battery and turns off the protection switch accordingly;

a shield member that shields at least the protection switch; and

an insulating member provided between the shield member and the protection circuit and between the shield member and the battery,

wherein the shield member is connected to one end of the load in a DC fashion, and

wherein the shield member is connected to an electrode other than a negative electrode of the battery that is connected to one end of the load in a high frequency fashion.

Please rewrite Claim 2 as follows:

2. (Amended) The power source according to claim 1, further comprising:

a negative electrode terminal connected to a negative electrode of the battery;

a voltage detection terminal connected to a positive electrode of the battery;

an overcurrent detection terminal to measure a current that flows through the protection switch; and

a control terminal that generates a signal to turn off the protection switch,

wherein the shield member shields the voltage detection terminal, the overcurrent detection terminal, and the control terminal.

REMARKS

Applicant has rewritten portions of the specification and Claims 1 and 2. The changes from the previous version to the rewritten version are shown in attached Appendix A, with strikethrough for deleted matter and underlines for added matter.

Respectfully submitted,

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APPENDIX A
Battery with Protection Circuit for Preventing Malfunction
Attorney Docket No. 9281-4198
Inventor Yuji Yanagisawa

In the Specification

Please amend the paragraph beginning on page 1, line 23 and ending on page 2 line 7 follows:

(Amended) The protection switch 25 comprises a charging shutdown switch 25a that shuts down charging to the batteries 21a and 21b and a discharging shutdown switch 25b that shuts down discharging from the battery to the load, and these switches are configured in the form of FETs. The source of the charging shutdown switch 25a is connected to the negative electrode 21f of the battery 21b and the drain of the charging shutdown switch 25a is connected to the source of the discharging shutdown switch 25b, and the drain of the discharging shutdown switch 25b is connected to the - terminal 23.

Please amend the paragraph beginning on page 4, line 23 and ending on page 5, line 3 as follows:

(Amended) An insulating member 32 consisting of a vinyl film is disposed so as to cover the substrate 30 partially including the detection integrated circuit 31 and the protection switch integrated circuit 32. However, the - terminal 23 is not covered with the insulating member 32. A shield member 33 consisting of a copper foil is provided on the insulating member 32, and the shield member 33 is connected to the - terminal 23 with ~~a~~ solder 34.

Please amend the paragraph on page 5, lines 4-21 as follows:

(Amended) Because, in the abovementioned conventional battery with a protection circuit, the shield member 33 is grounded at one soldered point, the ~~two shield members~~protection switch 25 and detection circuit 26 of the protection circuit 24 disposed at the point far from the solder 34 are not shielded sufficiently. As the result, an external radio wave passes through the shield member 33 and is superimposed on a current that flows through the protection circuit 24 due to electromagnetic induction, and the protection circuit 24 can ~~cause~~ malfunction. When the protection circuit 24 ~~causes~~ malfunctions, the protection switch 25 is

turned off even when overcharge, over-discharge, or overcurrent does not occur, and supply of power source voltage to the load can be shut down. Particularly the battery is used for a radio system that usually has an antenna near the battery with a protection circuit, which is exposed to a strong radio wave, and the low shield effect of the shield member 33 can cause malfunction of the radio system easily.

Please amend the paragraph beginning on page 7, line 14 and ending on page 8, line 1 as follows:

(Amended) FIG. 1 is a circuit diagram showing a battery with a protection circuit, and the battery comprises a power source 1 having batteries 1a and 1b connected in series, a protection circuit 4, and a + terminal 2 and a - terminal 3 connected to both ends of the power source 1 respectively. A load not shown in the drawing is connected between the + terminal 2 and the - terminal 3, and is ground at the portion that is connected to the - terminal 3. The protection circuit 4 has a protection switch 5 interpolated between the power source 1 and the load and a detection circuit 6 ~~that is served to~~ detects abnormalities of the batteries 1a and 1b and to turns off the protection switch 5.

Please amend the paragraph on page 8, lines 2-12 as follows:

(Amended) The protection switch 5 comprises a charging shutdown switch 5a that is served to shuts down charging to the battery, and a discharging shutdown switch 5b that ~~is served to~~ shuts down discharging from the battery to the load, and both switches are configured in the form of FETs. The source of the charging shutdown switch 5a is connected to the negative electrode 1f of the battery 1b, the drain of the charging shutdown switch 5a is connected to the source of the discharging shutdown switch 5b, and the drain of the discharging shutdown switch 5b is connected to the - terminal 3.

Please amend the paragraph beginning on page 8, line 13 and ending on page 9, line 2 as follows:

(Amended) The detection circuit 6 is provided with a positive electrode terminal 6a connected to the positive electrode (the positive electrode 1c of the battery 1a) of the power source, a middle point terminal 6b connected to the negative electrode 1d of the battery 1a and the positive electrode 1e of the battery 1b, a negative electrode terminal 6c connected to the negative electrode (the negative

electrode 1f of the battery 1b) of the power source 1, a delay terminal 6d connected to the detection delay capacitor 7a, a voltage detection terminal 6e connected to the positive electrode (the positive electrode 1c of the battery 1a) of the power source through a resistor 8a, an overcurrent detection terminal 6f connected to the - terminal 3 through a resistor 8b, a control terminal 6g connected to the gate of the protection switch 5a, and a control terminal 6h connected to the gate of the protection switch 5b.

Please amend the paragraph on page 9, lines 3-7 as follows:

(Amended) The protection switch 5 and the detection circuit 6 are covered with the insulating member 12 and shield member 13 as described hereinafter, and the negative electrode 1d of the battery 1a and the shield member 13 form a capacitor 7b together. Capacitor 7b is effectively connected between the ground and the negative electrode 1d of the battery 1a (or positive electrode 1e of battery 1a).

Please amend the paragraph on page 9, lines 12-19 as follows:

(Amended) When the battery becomes overcharged, the voltage difference between the voltage detection terminal 6e and the negative terminal 6c attains to a value equal to or higher than a predetermined value and the detection circuit 6 detects overcharging of the batteries 1a and 1b resultantly, and the control terminal 6g ~~becomes~~outputs a high level and the charging shutdown switch 5a of the protection switch 5 is turned off.

Please amend the paragraph on page 9, lines 20-27 as follows:

(Amended) On the other hand, when the battery becomes over-discharged, the voltage difference between the voltage detection terminal 6e and the negative electrode terminal 6c drops to a value equal to or lower than another predetermined value and the detection circuit 6 detects over-discharge, and the control terminal 6g ~~becomes~~outputs a high level and the discharging shutdown switch 5b of the protection switch 5 is turned off.

Please amend the paragraph on page 10, lines 1-10 as follows:

(Amended) Furthermore, when an overcurrent flows through the batteries 1a and 1b, a current that flows through the protection switch 5 increases to result in a large voltage drop between both ends of the protection switch 5, the voltage

difference between the overcurrent detection terminal ~~2~~6f and the negative terminal 6c becomes large, the detection circuit 6 detects the overcurrent, the control terminal 6g or 6h ~~becomes~~outputs a high level, and the charging shutdown switch 5a or the discharging shutdown switch 5b of the protection switch 5 is turned off.

Please amend the paragraph beginning on page 10, line 11 and ending on page 11, line 16 as follows:

(Amended) FIG. 2 is a perspective view showing the configuration of the battery with the protection circuit. The batteries 1a and 1b are rectangular and placed one on the other. The right side face not shown in the drawing of the lower side battery 1b ~~is served~~serves as the positive electrode 1e and other five faces ~~are~~ served as the negative electrode 1f. The battery 1a is disposed on the battery 1b with interposition of the insulating film 9a, and the left side face ~~is served~~serves as the positive electrode 1c and other five faces ~~are~~ served as the negative electrode 1d. The negative electrode 1d of the battery 1a is connected to the positive electrode 1e of the battery 1b with the metal foil 11c, and the batteries 1a and 1b are connected in series. A substrate 10 on which the protection circuit 4 is mounted is provided partially on the upper surface of the battery 1a. The detection circuit 6 having an integrated circuit structure and the protection switch 5 having an integrated circuit structure are disposed on the substrate 10. Furthermore, the positive electrode 1c of the battery 1a is connected to a wiring pattern (not shown) on the substrate 10 through the metal foil 11a, the negative electrode 1f of the battery 1b is connected to a wiring pattern on the substrate through the metal foil 11b, and the negative electrode 1d of the battery 1a and the positive electrode 1e of the battery 1b are connected to a wiring pattern on the substrate 10a through the metal foil 11c. Furthermore, the + terminal 2 consisting of a metal foil and the - terminal 3 consisting of a metal foil are connected to the substrate 10, and the + terminal 2 and the - terminal 3 are disposed on the side surfaces of the batteries 1a and 1b with interposition of the insulating film 9b.

Please amend the paragraph beginning on page 11, line 17 and ending on page 12, line 7 as follows:

(Amended) The insulating member 12 consisting of a vinyl film is disposed on the upper surface of the substrate 10 so as to cover the upper surface of the battery

1a partially, to cover the side surface of the battery 1a partially, and to cover the detection circuit 6 and the protection switch 5. The insulating member 12 does not cover the top side of the - terminal 3. The shield member 13 consisting of a copper foil is disposed on the insulating member 12 and the - terminal 3 so as to partially cover the - terminal 3, and the shield member 13 is connected in series to the - terminal 3 with solder 14. Because the upper surface and the side surface of the battery 1a ~~are~~ served as the negative electrode 1d of the battery 1a, the negative electrode 1d of the battery 1a, the insulating member 12, and the shield member 13 form the capacitor 7b. As the result, the shield member 13 is connected to the negative electrode 1d of the battery 1a in a high frequency fashion.

In the Claims

Please amend Claim 1 as follows:

1. (Amended) A ~~battery with a~~ power source~~protection circuit provided with~~ comprising:

~~a power source having~~ at least one battery;

a protection circuit ~~comprising~~including a protection switch ~~interpolated~~disposed between a load having one end that is grounded and the ~~power source~~battery and a detection circuit that detects one of overcharging ~~or~~and over-discharging of the battery and turns off the protection switch accordingly;

a shield member that shields at least the protection switch; and

an insulating member provided between the shield member and the protection circuit and between the shield member and the battery,

wherein the shield member is connected to one end of the load in a DC fashion, and

wherein the shield member is connected to an electrode other than a negative electrode of the battery that is connected to one end of the load in a high frequency fashion.

Please amend Claim 2 as follows:

2. (Amended) The ~~battery with the~~ power source/~~protection circuit~~ according to claim 1, ~~wherein the battery with the protection circuit is provided with~~further comprising:

a negative electrode terminal connected to a negative electrode of the ~~power source~~battery;

a voltage detection terminal connected to a positive electrode of the ~~power source~~battery;

an overcurrent detection terminal ~~that is used~~ to measure a current that flows through the protection switch; and

a control terminal that generates a signal to turn off the protection switch,

wherein the shield member shields the voltage detection terminal, the overcurrent detection terminal, and the control terminal.